

Self Instructional Material (SIM) on Educational Statistics for B.Ed. Students – An Experiment

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Abstract: *Individual differences are main barriers in the way of communication. No communication strategy can satisfy every learner/student at the same time in the classroom situation. It has given birth to an idea of developing remedial measures and to assess their effectiveness among slow learners. Teacher training at degree level (B.Ed.) has variety of students coming from different disciplines. Most of them, having no background of elementary statistics are supposed to understand central tendency (mean, median and mode) and its application in classroom situation. As a result, they fail to get even passed marks in the course content. Keeping this problem in mind, the investigators decided to develop self instructional material in Educational Statistics and assess its effect among B.Ed. students for enhancing the level of their knowledge in elementary statistics and change in attitude towards mathematics. Many a times students do visualize the theme of lecture delivered by their teachers. It is really very difficult for an average student to imagine different phrases of formula and significant meaning of various statistical terms. Proper visualization and memory skill are needed for proper comprehension. Hence, there is a need to develop some new strategy, which will be a channel between teachers and learners of Educational Statistics for an easy flow of information and practical application in evaluation procedure.*

Introduction

Major characteristic of Self Instructional Material (SIM) is to create a learning environment for making the learner to learn. It contains the answers of all possible queries, confusions and questions that may come in the mind of the learner at the time of learning. It generates a two-way communication with the learner and provides him immediate feedback on his performance. This activity maintains high interest level and provides motivation to the learner.

Considering these characteristic of SIM, the investigators decided to develop and try out Self Instructional Material for B.Ed. students in Educational Statistics.

The following research objectives were formulated for this project.

- To diagnose learners difficulties in learning Educational Statistics.
- To assess the change in level of knowledge among learners regarding statistical terms.
- To compare the level of retention of knowledge by SIM and TCR strategy.

- To assess learners' opinion towards SIM strategy.
- To assess change in attitude towards Ed. Statistics among B.Ed. students.
- To verify the effectiveness of SIM over TCR strategy.
- To determine overall impact of SIM strategy on the learners of B.Ed. Programme.
- To suggest some other remedies if proposed SIM strategy is not found significantly effective.

Hypothesis for the study

Major hypothesis

There is no significant difference in competency level between the learners of experimental group and controlled group.

Minor hypotheses

For detailed verification of objectives, following minor hypotheses were framed:-

1. There is no significant difference in the level of knowledge among the students learning through SIM and TCR strategy.
2. The opinion of the learners towards SIM strategy may not be favourable.
3. There will not be any significant difference in learner's achievement between pre-test of both the groups
4. There will not be any significant difference in learner's achievement between post-test and retention test of both the groups.
5. There will not be any significant difference in learner's achievement between pre-test and retention test of both groups.
6. There will not any significant difference regarding attitude towards educational statistics between learners of both groups.
7. There will not be any significant difference in effectiveness of SIM among different categories of learners.
8. There will not be any significant difference in achievement of learners learning through SIM and TCR strategies after retention test.

Delimitations of the Study

This study was limited to B.Ed. students only. Both male and female students were included in this experiment. The age limit or socio-economic, and status of previous educational background of students were not taken into consideration.

Methodology Adopted

In this experimental research a comparison between two strategies as 'Traditional Classroom Teaching' and 'Self-Instructional Material' for learning statistics was done. The learning environment for both groups was created. Two identical groups,

of 35 students in each were formed on the basis of IQ and their achievement in Xth class. One group received instructions under TCR strategy (referred to as Controlled group), while another group received instruction under SIM strategy (referred to Experimental group). The investigators helped learners of both the groups to learn Educational Statistics through respective strategy for one month. After the experimentation, post test and retention test were conducted.

An achievement test designed by the researcher was employed as pretest, posttest and retention test. An opinion scale of ten statements was used to find out students' opinion towards SIM strategy. Learners Attitude towards Educational Statistics was collected two times with the help of a Mathematics Attitude scale. The effectiveness of SIM was statistically analysed for drawing out inferences. The learning outcomes were verified statistically for drawing some conclusion. The investigators interviewed about 30 students for revealing their problems related to Educational Statistics. They could not understand various formulae and their application in solving problems of educational statistics. They committed mistakes in calculating Mean, Median, Mode, Standard Deviation, Quartile deviation etc. They had confusion in deciding class interval. These findings helped the investigator in framing the learning strategy for Self Instructional Material.

Tools used

Achievement Test: In first instance the investigators developed a list of about 20 questions covering the course content of Central Tendency for B.Ed. students. These questions were discussed with various experts from statistics, education and testing experts. Their valuable suggestions were incorporated. Finally, a questionnaire having five questions was framed along with answer sheet. This questionnaire had all the questions as long answer questions. It was used as pretest, posttest and retention test for both groups.

Attitude Test: The investigators adopted a standardised test developed by Dr. Satish Rastogi for assessing learners' attitude towards Mathematics. This test has entries for general information about the students, instructions to them and finally 24 statements (both positive and negative) for assessing learner's attitude towards Mathematics. This test was used as pretest and posttest.

Opinion scale: The investigators, while monitoring students learning and interaction with self instruction material, observed following points :-

- | | |
|-----------------------|---------------|
| 1. Easiness | 5. Motivating |
| 2. Self learning | 6. Economical |
| 3. Direct interaction | 7. Portable |
| 4. Better than TCR | |

A detailed opinionnaire was developed and tried out among all the participants of experimental group by the investigators.

The TCR group studied through the traditional classroom teaching while the experimental group had classroom teaching and SIM for home study. Below is experimental design for this project.

	Pre test	Post test	Retention test
Experimental Group	x_1	x_2	x_3
Controlled Group	y_1	y_2	y_3

Significance of difference between any two situations were analysed statistically.

Difficulties during experimentation.

1. Selection of some suitable IQ test was not possible in Bhandara or Nasik due to having no psychological laboratory. J.C. Raven test was taken from NCERT, New Delhi as non-verbal test for I.Q.
2. The cooperation, interest, willingness, motivation and finally active involvement of the target group were a problem. The necessary support from academic staff of B.Ed. College was taken for neutralizing these variables.
3. The target group was too heterogeneous because the students were from different academic backgrounds, like Arts, Commerce, Science, etc.

Analysis of Data

The results shown in Table 1 were obtained after an analysis of learner performance in both groups during pre, post and retention tests.

Table 1: Comparison of knowledge level

Situations Groups	Pre-test (1)		Post-test (2)		Retention test (3)		Remarks
	Mean	SD	Mean	SD	Mean	SD	
Experimental Group N=35(x)	23.53	14.02	76.42	11.21	79.59	11.05	$t_{x_1x_3} = 5.22$, $t_{y_2y_3} = 0.48$, $t_{x_2x_3} = 0.23$
TCR Group N=35(y)	23.18	16.05	59.21	14.33	52.16	18.94	
$t_{x_1y_1} = 0.10$, $t_{x_2y_2} = 5.74$, $t_{x_3y_3} = 7.64$, $t_{y_1y_2} = 2.11$, $t_{x_1x_2} = 4.51$, $t_{y_1y_3} = 1.59$, $r_{y_1y_2} = 0.41$, $r_{y_1y_3} = 0.61$, $r_{y_2y_3} = 0.54$, $r_{x_1x_2} = 0.61$, $r_{x_1x_3} = 5.22$, $r_{x_2x_3} = 0.37$							

Data stated in Table 1 indicated that mean difference between both the groups at pre test stage was not significant at 0.05 level. It indicated that both groups were almost similar. Both the groups at the post test stage and the retention stage had significant difference (at 0.01 level). It indicated that self learning materials produced more learning and finally more retention. The TCR strategy was also found effective because difference between pre-test and post-test was significant at 0.05 level but in case of SIM group it was highly significant at 0.01 level. It indicated that SIM group students gained more knowledge than TCR group. The level of retention in TCR group was found not significant when compared with pre test marks. While in case of Experiment group this difference was significant at .01 level. This SIM group had

more retention level than TCR group. Both groups had no significant difference between post-test and retention test at .05 level.

Table 2: Comparison of attitude level

Situations Groups	Pre-test (1)		Post-test (2)		Remarks
	Mean	SD	Mean	SD	
Experimental Group N=35(x)	70.69	23.89	95.98	20.14	$r_{y_1y_2} = 0.19$
TCR Group N=35(y)	69.87	20.98	90.26	21.56	$r_{x_1x_2} = 0.52$
$t_{x_1y_1} = 0.16, t_{x_2y_2} = 1.23, t_{x_1x_2} = 1.09, t_{y_1y_2} = 0.69$					

At the pre test stage both groups were similar because the attitude of both groups at pre-test stage towards educational statistics was almost similar having no significant difference even at (0.05) level. At post-test stage also, the difference was not significant at (0.05) level. It indicated that both groups were having almost similar attitude level even after experimentation. Also, the differences between pre-tests and post-tests for both groups were not significant even at 0.05 level. This indicated that the experimentation could bring no change in attitude in both groups.

Table 3: Comparison of questionwise marks in achievement test (TCR Group)

Situations Q. No.	Pre-test (X)		Post-test (Y)		Retention test (Z)		Remarks
	Mean	SD	Mean	SD	Mean	SD	
1	11.13	.64	17.64	1.94	17.86	1.96	$t_{x_1y_1} = 3.96, r_{x_1y_1} = 0.54$
2	5.13	1.35	9.64	1.64	52.16	1.71	$t_{x_2y_2} = 3.34, r_{x_2y_2} = 0.47$
3	10.63	1.24	17.54	1.42	17.73	1.42	$t_{x_3y_3} = 5.57, r_{x_3y_3} = 0.51$
4	4.12	1.48	9.69	1.62	9.76	1.60	$t_{x_4y_4} = 3.76, r_{x_4y_4} = 0.50$
5	26.12	1.96	34.69	1.74	34.77	1.71	$t_{x_5y_5} = 5.02, r_{x_5y_5} = 0.48$
$t_{x_1z_1} = 3.99, t_{x_2z_2} = 3.41, t_{x_3z_3} = 5.61, t_{x_4z_4} = 3.79, t_{x_5z_5} = 5.13$							
$r_{x_1z_1} = 0.59, r_{x_2z_2} = 0.56, r_{x_3z_3} = 0.57, r_{x_4z_4} = 0.58, r_{x_5z_5} = 0.54$							
$t_{y_1z_1} = 0.11, t_{y_2z_2} = 0.89, t_{y_3z_3} = 0.64, t_{y_4z_4} = 0.04, t_{y_5z_5} = 0.046$							
$r_{y_1z_1} = 0.64, r_{y_2z_2} = 0.62, r_{y_3z_3} = 0.63, r_{y_4z_4} = 0.67, r_{y_5z_5} = 0.61$							

Table 3 indicates that 't' values for all questions between pre and post tests were higher than standard value (2.73) and so the differences were highly significant. Similarly, between pre and retention tests, the differences were again significant at 0.01 level for all the questions and so there was a significant level of retention for

this group. But, in case of t values for post and retention (less than 2.73) for all questions, the knowledge level at the post and retention stages were almost similar for TCR group.

The Table 4 reveals that in all questions the t values are higher than standard value (2.73) indicating that the differences in performances were significant. Similarly, this difference between pre test and retention test was significant at 0.01 level indicating that there was a significant retention for all questions. The difference between post test and retention test, was also significant at 0.01 level, indicating that SIM strategy was found effective among Experimental group learners.

Table 4: Comparison of questionwise marks in achievement test (Experimental Group)

Q. No.	Pre-test (X)		Post-test (Y)		Retention Test (Z)		Remarks
	Mean	SD	Mean	SD	Mean	SD	
1 TM=20	11.13	1.64	17.87	1.68	18.68	1.65	$t_{x_1y_1} = 4.12, r_{x_1y_1} = 0.64$
2 TM=10	5.13	1.35	9.92	1.40	9.96	1.33	$t_{x_2y_2} = 3.52, r_{x_2y_2} = 0.61$
3 TM=20	10.63	1.24	18.69	1.29	19.23	1.25	$t_{x_3y_3} = 6.35, r_{x_3y_3} = 0.63$
4 TM=10	4.12	1.48	9.92	1.51	9.93	1.44	$t_{x_4y_4} = 3.86, r_{x_4y_4} = 0.66$
5 TM=40	26.12	1.96	38.79	1.94	38.86	1.81	$t_{x_5y_5} = 6.31, r_{x_5y_5} = 0.61$
$t_{x_1z_1} = 4.58, t_{x_2z_2} = 3.79, t_{x_3z_3} = 6.83, t_{x_4z_4} = 5.801, t_{x_5z_5} = 6.87$							
$r_{x_1z_1} = 0.72, r_{x_2z_2} = 0.70, r_{x_3z_3} = 0.73, r_{x_4z_4} = 0.76, r_{x_5z_5} = 0.69$							
$t_{y_1z_1} = 0.49, t_{y_2z_2} = 0.020, t_{y_3z_3} = 0.425, t_{y_4z_4} = 0.006, t_{y_5z_5} = 0.038$							
$r_{y_1z_1} = 0.87, r_{y_2z_2} = 0.84, r_{y_3z_3} = 0.86, r_{y_4z_4} = 0.89, r_{y_5z_5} = 0.81$							

Major Findings

The achievement test was given three times to both the groups as pre-test, post-test, and retention test. The statistical analysis revealed that a significant change in level of knowledge regarding Educational Statistics was obtained in both the groups. Thus Objective 2 was achieved and minor Hypothesis 1 was not accepted. Also, learning in both the groups was enhanced to a significant level, and there was more retention through SIM strategy. This indicated that SIM strategy was more effective among students than TCR strategy. Thus, Objective 3 was achieved and minor Hypotheses 8 was not accepted.

An open-ended opinionnaire having ten statements was supplied to the students of SIM strategy. The analysis revealed that the learners found this SIM strategy as interactive, helpful, interesting and capable to involving the learners in the process of

learning. Thus, Objective 4 was achieved and minor Hypothesis 2 was not accepted. It was interesting to note that the attitude of the learners could not be changed as per data analysis obtained with the help of attitude scale used in this project. In fact, attitude is a variable, which is developed and changed after a long span of time. This was an experiment, which had been completed within a short span of time with minimum opportunity of drill. Thus, Objective 5 was achieved and the Hypotheses 4 was accepted.

The investigator compared SIM strategy with TCR strategy to find out their effectiveness. Though, it was found that the level of knowledge enhanced is similar by both the strategies, yet there is a significant difference in the level of retention between SIM and TCR strategy. The level of retention in SIM strategy was found higher than the TCR strategy. Thus, Objective 6 was achieved and Hypothesis 6 was rejected. The results indicated that the overall impact of SIM strategy was more in the experimental group than that in the controlled group. There is no statistical evidence about the level of interest, motivation, involvement, but the personal observation of investigators revealed that they were more enthusiastic and, motivated for learning through SIM strategy. Thus Objective 7 was achieved.

The SIM strategy was found more effective than TCR strategy. Computer Assisted Learning (CAL) strategy can also be suggested for bringing better retention and with more problem solving capacity among the students of B.Ed. Colleges, which are equipped with Computer facility.

Recommendations for Further Research

1. Effectiveness of SIM can be assessed if the instructor in learning process assists the learners in such assessment.
2. Such SIM can be developed and tried out for other topics in Mathematics
3. SIM can be effectively developed and applied for other subjects also.
4. Comparison between SIM strategy and CAL strategy can be studied.
5. Effectiveness of SIM strategy can be assessed, if it is combined with group discussion.

Outcome of this Research

Learning is a phenomenon which requires individual guidance, personal attention and overall individual efforts of the learners. Classroom teaching has very little chance for the learner to be active during the learning process. Moreover, B.Ed. syllabus includes Co-curricular activities, sports, school visits, practice teaching, educational tour, etc. that cover major portion of the educational session. So, there is lack of time for practice of statistics. The SIM provides this opportunity to the learners who learn through their own efforts. Also, they can rectify their mistakes

and maintain their own pace of learning. This fact has been verified in this study. This experiment will provide useful insight to teachers, students and others involved in competency-based learning of various subjects.

Conclusion

The investigators analyzed the learner's performance on achievement test for both the groups three times as pre-test, post-test and retention test. They also analysed learner's attitude towards Maths : pre-test and post-test. The opinions of the SIM group towards SIM strategy was analyzed. It was found that difference between pre-test of both the groups was not significant but it was significant for post-test and retention test of both the groups. Similarly the difference in attitude before and after learning by both the groups was not found significant at 0.05 level. The SIM strategy and TCR strategy were both found equally effective in raising level of knowledge. Also, the difference between the post-test and retention test for SIM and TCR groups were not significant. The analysis showed that attitude difference in pre-test and post-test for both the groups was not significant. Question-wise analyses of achievement test suggest that SIM strategy was more effective in raising level of comprehension and application.

Thus, it was clear that both SIM and TCR were effective in enhancing the level of knowledge regarding 'measures of central tendency' but could not change the attitude of the learners towards Mathematics. It is expected that SIM strategy developed by the investigators may serve as means of interaction for optimum learning of Educational Statistics in absence of teacher trainers.

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